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ABSTRACT

This is the student's edition of the Record Book for the unit "Crusty Problems" of the Intermediate Science Curriculum Study (ISCS) for level III students (grade 9). Space is provided for answers to the questions from the text as well as for the optional excursions and the self evaluation. An introductory note to the student explains the use of the book. (SA)

Crusty Problems

Probing the Natural World/3

INTERMEDIATE

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INTERMEDIATE SCIENCE CURRICULUM STUDY

Record Book

Crusty Problems

Probing the Natural World / Level III

...ER BURDETT
GENERAL LEARNING CORPORATION
Morristown, New Jersey . Park Ridge, Ill. . Palo Alto . Dallas . Atlanta

ISCS PROGRAM

LEVEL I. **Probing the Natural World** / Volume 1 / with Teacher's Edition
Student Record Book / Volume 1 / with Teacher's Edition
Master Set of Equipment / Volume 1
Test Resource Booklet

LEVEL II **Probing the Natural World** / Volume 2 / with Teacher's Edition
Record Book / Volume 2 / with Teacher's Edition
Master Set of Equipment / Volume 2
Test Resource Booklet

LEVEL III **Why You're You** / with Teacher's Edition
~~Record Book / with Teacher's Edition / **Master Set of Equipment**~~
Environmental Science / with Teacher's Edition
Record Book / with Teacher's Edition / **Master Set of Equipment**
Investigating Variation / with Teacher's Edition
Record Book / with Teacher's Edition / **Master Set of Equipment**
In Orbit / with Teacher's Edition,
Record Book / with Teacher's Edition / **Master Set of Equipment**
What's Up? / with Teacher's Edition
Record Book / with Teacher's Edition / **Master Set of Equipment**
Crusty Problems / with Teacher's Edition
Record Book / with Teacher's Edition / **Master Set of Equipment**
Winds and Weather / with Teacher's Edition
Record Book / with Teacher's Edition / **Master Set of Equipment**
Well-Being / with Teacher's Edition
Record Book / with Teacher's Edition / **Master Set of Equipment**

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Foreword

A pupil's experiences between the ages of 11 and 16 probably shape his ultimate view of science and of the natural world. During these years most youngsters become more adept at thinking conceptually. Since concepts are at the heart of science, this is the age at which most students first gain the ability to study science in a really organized way. Here, too, the commitment for or against science as an interest or a vocation is often made.

Paradoxically, the students at this critical age have been the ones least affected by the recent effort to produce new science instructional materials. Despite a number of commendable efforts to improve the situation, the middle years stand today as a comparatively weak link in science education between the rapidly changing elementary curriculum and the recently revitalized high school science courses. This volume and its accompanying materials represent one attempt to provide a sound approach to instruction for this relatively uncharted level.

At the outset the organizers of the ISCS Project decided that it would be shortsighted and unwise to try to fill the gap in middle-school science education by simply writing another textbook. We chose instead to challenge some of the most firmly established concepts about how to teach and just what science material can and should be taught to adolescents. The ISCS staff have tended to mistrust what authorities believe about schools, teachers, children, and teaching until we have had the chance to test these assumptions in actual classrooms with real children. As conflicts have arisen, our policy has been to rely more upon what we saw happening in the schools than upon what authorities said could or would happen. It is largely because of this policy that the ISCS materials represent a substantial departure from the norm.

The primary difference between the ISCS program and more conventional approaches is the fact that it allows each student to travel at his own pace, and it permits the scope and sequence of instruction to vary with his interests, abilities, and background. The ISCS writers have systematically tried to give the student more of a role in deciding what he should study next and how soon he should study it. When the materials are used as intended, the ISCS teacher serves more as a "task easer" than a "task master." It is his job to help the student answer the questions that arise from his own study rather than to try to anticipate and package what the student needs to know.

There is nothing radically new in the ISCS approach to instruction. Outstanding teachers from Socrates to Mark Hopkins have stressed the need to personalize education. ISCS has tried to do something more than pay lip service to this goal. ISCS' major contribution has been to design a system whereby an average teacher, operating under normal constraints, in an ordinary classroom with ordinary children, can indeed give maximum attention to each student's progress.

The development of the ISCS material has been a group effort from the outset. It began in 1962, when outstanding educators met to decide what might be done to improve middle-grade science teaching. The recommendations of these conferences were converted into a tentative plan for a set of instructional materials by a small group of Florida State University faculty members. Small-scale writing sessions conducted on the Florida State campus during 1964 and 1965 resulted in pilot curriculum materials that were tested in selected Florida schools during the 1965–66 school year. All this preliminary work was supported by funds generously provided by The Florida State University.

In June of 1966, financial support was provided by the United States Office of Education, and the preliminary effort was formalized into the ISCS Project. Later, the National Science Foundation made several additional grants in support of the ISCS effort.

The first draft of these materials was produced in 1968, during a summer writing conference. The conferees were scientists, science educators, and junior high school teachers drawn from all over the United States. The original materials have been revised three times prior to their publication in this volume. More than 150 writers have contributed to the materials, and more than 180,000 children, in 46 states, have been involved in their field testing.

We sincerely hope that the teachers and students who will use this material will find that the great amount of time, money, and effort that has gone into its development has been worthwhile.

Tallahassee, Florida — *The Directors*
February 1972 — INTERMEDIATE SCIENCE CURRICULUM STUDY

Contents

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Notes to the Student

This Record Book is where you should write your answers. Try to fill in the answer to each question as you come to it. If the lines are not long enough for your answers, use the margin, too.

Fill in the blank tables with the data from your experiments. And use the grids to plot your graphs. Naturally, the answers depend on what has come before in the particular chapter or excursion. Do your reading in the textbook and use this book only for writing down your answers.

Additional questions I have thought about:

1. ______________________________

2. ______________________________

3. ______________________________

4. ______________________________

5. ______________________________

☐ 1-1. ______________________________

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☐ 1-2. ______________________________

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☐ 1-3. ______________________________

☐ 1-4. ______________________________

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Activity 1-1. Use map on the next page.

☐ **1-5.** ______

☐ **1-6.** ______

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☐ **1-7.** ______

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☐ **1-8.** ______

☐ **1-9.** ______

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☐ **1-10.** ______

☐ **1-11.** ______

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☐ **1-12.** ______

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☐ **1-13.** ______

☐ **1-14.** ______

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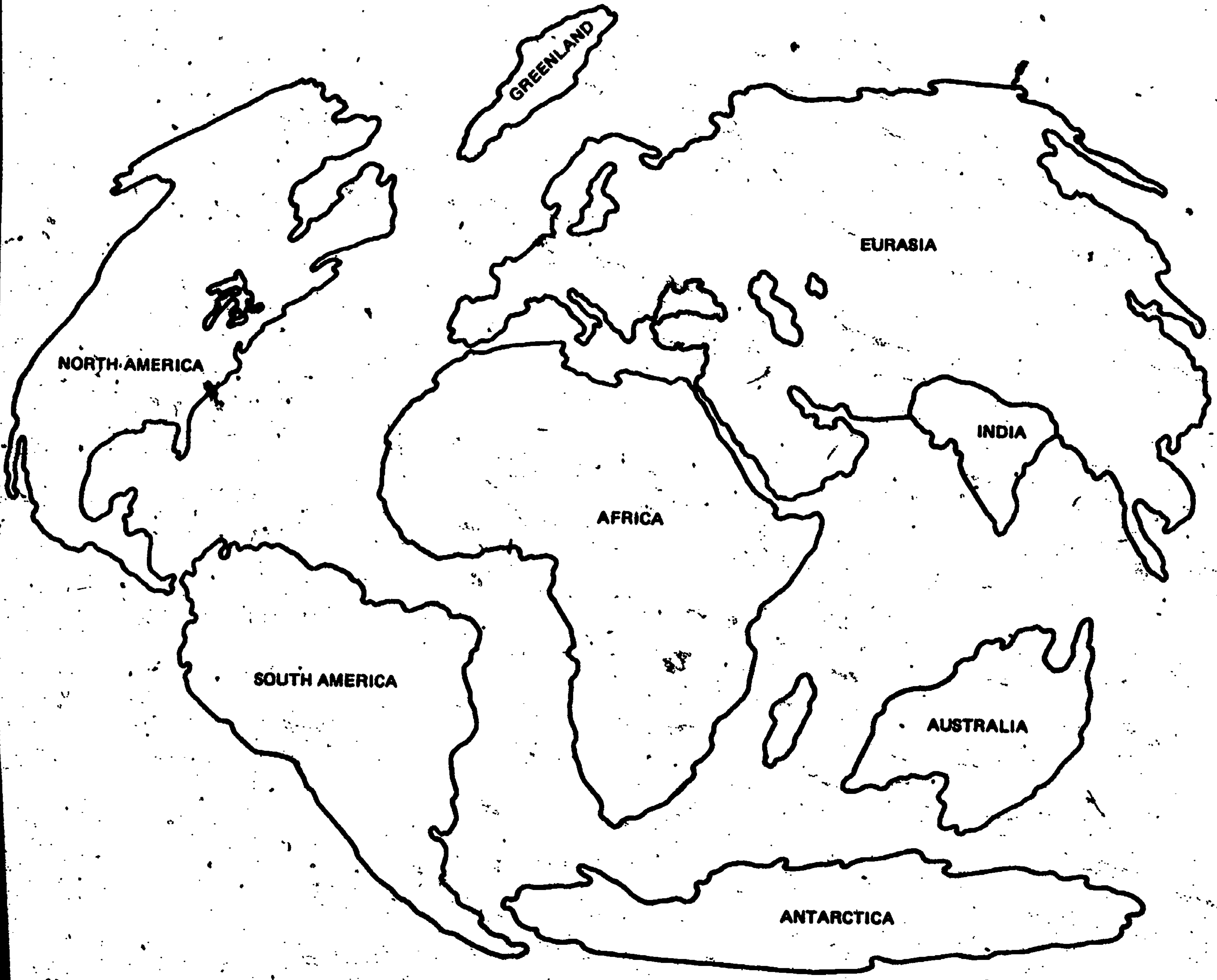
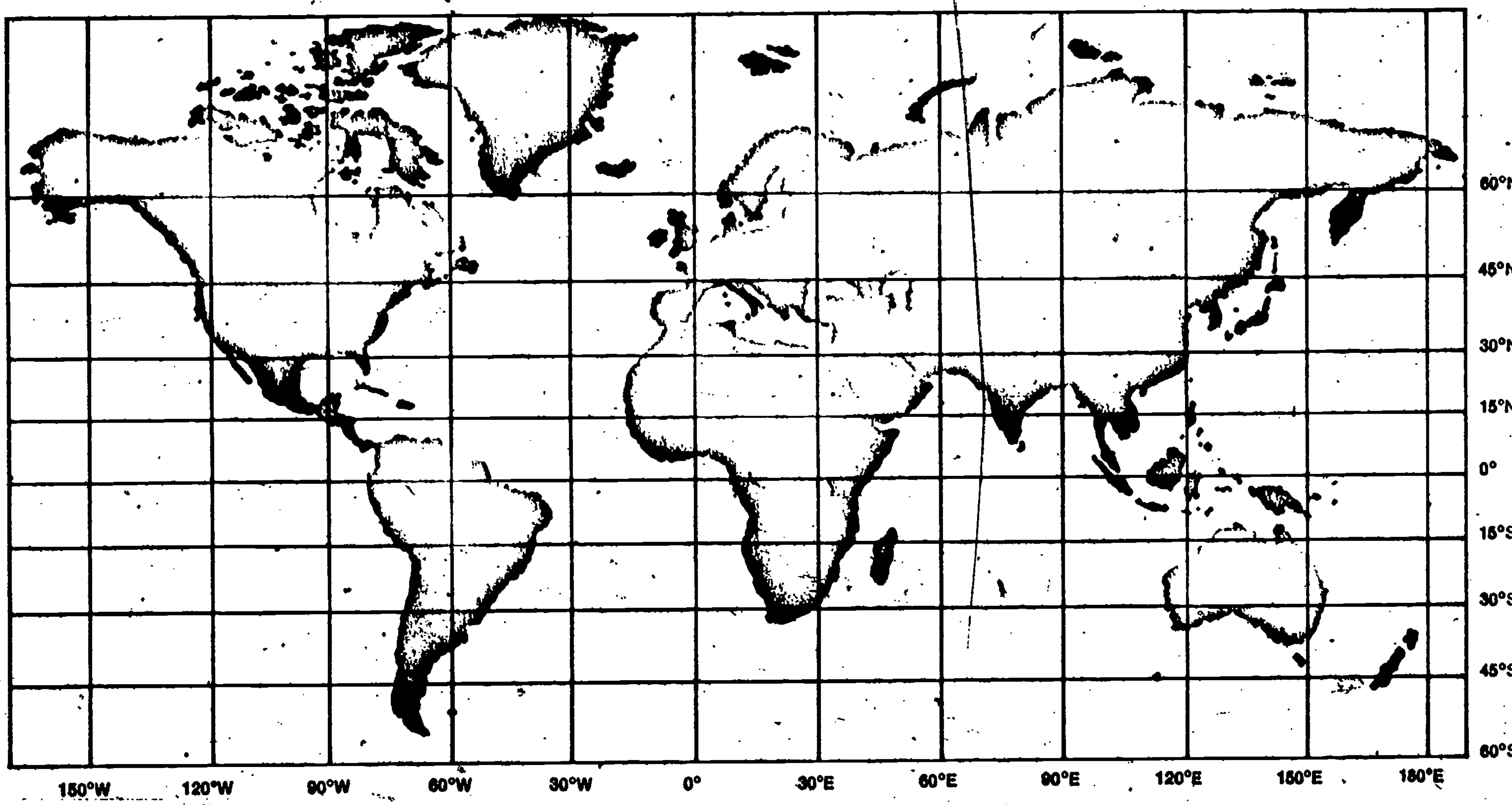

GREENLAND
EURASIA
NORTH AMERICA
AFRICA
INDIA
SOUTH AMERICA
AUSTRALIA
ANTARCTICA

SELECTED DATA FOR DETERMINATION OF EPICENTERS

Day GMT	Origin Time GMT			Geographic Coordinates		Region and Comments	Depth KM	Magnitudes ERL	
	HR	MN	SEC	LAT	LONG			MB	MS
1	01	16	16.8	6.4 S	130.3 E	Banda Sea	133	5.8	
1	01	56	47.0	7.5 S	156.3 E	Solomon Islands	48	4.9	
1	05	40	06.2	22.1 S	170.1 E	Loyalty Islands Region	24		
1	05	53	34.9	21.7 N	143.0 E	Mariana Islands Region	310	4.0	
1	09	35	37.6	11.0 S	165.0 E	Santa Cruz Islands	N	4.4	
1	11	58	00.9*	15.4 S	173.1 W	Tonga Islands	17	5.0	
1	12	13	27.6	36.4 N	43.4 E	Iraq	16	5.1	
						Felt at Mosul.			
1	14	37	25.7	36.7 N	68.3 E	Hindu Kush Region	N	4.6	
1	15	42	27.0*	47.1 N	17.9 E	Hungary	N	4.0	
1	19	01	18.3	43.2 N	146.5 E	Kuril Islands	56	4.7	
						Felt on Hokkaido.			
1	20	53	29.9*	0.8 S	120.4 E	Northern Celebes	124	4.9	
2	03	35	48.6	35.2 N	36.3 W	North Atlantic Ridge	N	4.7	
2	08	01	13.3	21.0 S	68.4 W	Chile-Bolivia Border Region	115 D	4.8	
2	09	18	32.5 P	34.2 N	117.5 W	Southern California	10		
						34°14.0′ N., 117°31.2′ W.			
						Preliminary Hypocenter and Mag.			
						(3.2) by Pas.			
2	15	35	26.2*	28.0 N	111.8 W	Gulf of California	N	3.8	
3	04	05	53.8	35.1 N	27.8 E	Dodecanese Islands	34	4.7	
3	04	07	44.3	21.5 S	179.1 W	Fiji Islands Region	600 G	5.3	
3	04	26	22.1	41.3 N	79.3 E	Kirgiz-Sinkiang Border Region	17	4.9	
3	05	23	08.0*	30.1 S	75.4 E	Mid-Indian Rise	N		
3	08	10	05.2	8.4 S	111.3 E	Java	79	5.6	
3	15	40	59.7	23.9 S	66.6 W	Jujuy Province, Argentina	197	4.7	
3	17	18	19.2*	21.1 S	68.8 E	Mid-Indian Rise	N	4.6	
3	18	28	45.2*	36.2 N	141.1 E	Near East Coast of Honshu, Japan	35	4.3	
						Felt (II JMA) in Eastern Honshu.			
4	09	25	56.9*	56.1 S	27.4 W	South Sandwich Islands Region	N	5.7	5.8
4	14	42	30.2	51.7 N	174.1 W	Andreanof Islands, Aleutian Is.	26	4.9	
4	18	33	18.0*	43.6 N	147.9 E	Kuril Islands	N	4.6	
4	22	15	55.4	20.6 S	69.0 W	Northern Chile	86	5.0	
4	22	51	28.9	6.9 S	155.5 E	Solomon Islands	62	5.0	
5	01	21	05.1	33.0 S	178.6 W	South of Kermadec Islands	N	5.1	
5	02	50	50.3	61.4 N	147.8 W	Southern Alaska	48	3.6	
5	16	52	47.6	41.8 N	32.5 E	Turkey	6	4.3	
6	13	28	26.9	51.2 N	179.2 W	Andreanof Islands, Aleutian Is.	34	4.1	
6	19	22	39.4	37.5 N	116.6 W	Southern Nevada	5 G	3.6	
7	05	35	15.6*	18.4 N	100.2 W	Guerrero, Mexico	88	4.2	
7	11	27	34.7*	23.5 N	44.8 W	North Atlantic Ridge	N	4.6	
8	05	54	12.4	19.1 N	68.0 W	North Atlantic Ocean	48	5.0	
8	07	17	05.0	41.1 S	72.6 W	Near Coast of Southern Chile	90	4.4	
						Felt (III) at Valdivia.			
8	08	02	37.2*	0.9 S	78.5 W	Ecuador	28	4.1	
8	14	00	00.1A	37.1 N	116.1 W	Southern Nevada	0	5.5	
						37°06′ 36.4″ N., 116°03′05.1″ W.			
						Nevada Test Site. Miniata (AEC).			
						Mag. 5 1/4 (BRK).			
8	14	39	56.8	19.1 N	64.4 W	Virgin Islands	N	4.6	
9	03	03	18.7	32.5 S	71.2 W	Near coast of Central Chile 83 killed, 447 injured, and widespread property damage in Central Chile. 1.2-meter Tsunami (Peak to Trough) at Valparaiso. Mag. 7.5 (PAS), 7.5 (BRK).	58	6.6	

EPICENTER DATA-(continued)

Day GMT	Origin Time GMT HR	MN	SEC	Geographic Coordinates LAT	LONG	Region and Comments	Depth KM	Magnitudes ERL MB	MS
9	04	46	25.6	32.5 S	71.4 W	Near Coast of Central Chile	69	4.5	
9	09	52	50.4*	3.8 N	78.5 W	South of Panama	57	4.3	
9	12	27	24.5	20.5 S	178.1 W	Fiji Islands Region	550 G	5.1	
9	15	46	49.9*	53.0 S	22.9 E	South of Africa	N	4.6	
9	17	00	52.1*	8.2 S	148.2 E	East New Guinea Region	62		
9	17	11	55.5*	43.5 N	147.6 E	Kuril Islands	N	4.2	
10	00	26	35.3*	32.4 S	71.4 W	Near Coast of Central Chile	65	4.3	
10	17	22	37.2*	40.4 N	109.6 W	Utah	8	3.8	
11	05	30	53.9	0.9 S	13.3 W	North of Ascension Island	N	5.1	
11	11	43	13.2*	23.4 N	123.7 E	Southwestern Ryukyu Islands	34	4.8	
11	12	51	33.7*	8.2 N	38.0 W	Central Mid-Atlantic Ridge	N	4.5	
12	09	02	09.2	24.0 N	111.2 W	Baja California	N	4.8	
12	23	50	15.7*	19.6 N	63.0 W	Leeward Islands	N	4.2	
14	07	16	53.6*	5.8 S	153.2 E	New Ireland Region	N	4.9	
14	14	48	41.2	47.8 N	114.4 W	Montana	5 G		
14	15	40	48.6*	60.0 N	152.7 W	Southern Alaska	82	4.0	
14	15	51	58.1	32.9 S	72.1 W	Off Coast of Central Chile	62	4.8	
14	19	53	14.3	0.8 N	29.0 W	Central Mid-Atlantic Ridge	N	5.2	5.3
15	01	33	22.3	44.8 N	10.3 E	Northern Italy	8	5.2	
						2 killed. Damage at Parma. Felt throughout Northern Italy.			
15	05	36	11.6	60.1 N	153.3 W	Southern Alaska	150	4.4	
15	06	15	31.4	37.2 N	36.8 E	Turkey	N	4.6	
15	10	38	50.0P	34.2 N	117.5 W	Southern California	10		
						34°14.1′ N., 117°27.7′ W.			
						Preliminary Hypocenter and MAG. (3.0) by PAS.			
15	10	57	02.4*	41.7 N	142.6 E	Hokkaido, Japan Region	57	4.1	
						Felt at Urakawa (II JMA) and Hachinohe. (I JMA).			
15	18	49	07.3	44.8 N	10.3 E	Northern Italy	19	4.0	
16	04	31	28.4*	59.3 N	154.2 W	Southern Alaska	N		
						Mag. 3.5 ML (ERL).			
16	05	50	23.7	35.0 N	23.1 E	Crete	42	4.5	
16	21	40	23.1	16.7 N	96.1 W	Oaxaca, Mexico	14	5.2	
17	03	23	53.6	15.3 N	45.3 W	North Atlantic Ridge	N	4.6	
17	03	39	15.4	55.3 N	161.5 W	Alaska Peninsula	N	4.3	
17	05	32	42.9	7.0 N	94.7 E	Nicobar Islands Region	138 D	5.8	
17	15	00	55.4	26.5 N	93.2 E	Eastern India	49	5.3	5.1
17	17	56	13.9	4.0 S	80.8 W	Peru-Ecuador Border Region	35 G	4.8	
17	19	30	14.1E	49.8 N	114.8 W	British Columbia	0		
						Strip Mine Explosion.			
17	20	10	21.5	21.5 S	68.2 W	Chile-Bolivia Border Region	123	5.4	
17	21	45	23.6	38.3 N	39.9 E	Turkey	N	4.5	
18	00	02	26.2*	34.0 N	45.2 E	Iran-Iraq Border Region	N	4.7	
18	16	18	22.8	45.7 N	26.3 E	Rumania	137	4.6	
18	19	16	41.7*	18.3 N	100.7 W	Guerrero, Mexico	110	4.7	
21	03	00	32.2*	1.2 S	14.9 W	North of Ascension Island	N	4.5	
21	09	14	26.1B	36.2 N	120.9 W	Central California	8	4.2	
						36°12.9′ N., 120°52.7′ W.			
						Hypocenter and Mag. (3.3) by Brk.			
21	20	01	57.1*	30.9 N	41.6 W	North Atlantic Ridge	N	4.3	
22	06	29	49.0	31.1 N	41.6 W	North Atlantic Ridge	N	4.8	
25	15	31	11.4	41.3 N	29.5 W	Azores Islands Region	N	4.6	
23	15	44	27.4	47.8 N	114.3 W	Montana	5 G		
						Felt at Kerr Dam.			
						Mag. 3.5 Ml (ERL).			
24	20	24	30.6*	37.9 S	49.4 E	Atlantic-Indian Rise	N	5.0	


60°N
45°N
30°N
15°N
0°
15°S
30°S
45°S
60°S
150°W
120°W
90°W
60°W
30°W
0°
30°E
60°E
90°E
120°E
150°E
180°E

RESOURCE 1.

☐ 1. ____________________

____

____

____

☐ 2. ____________________

RESOURCE 2

☐ 1. ____________________

☐ 2. ____________________

☐ 3. ____________________

____

____

RESOURCE 4.

☐ 1. ____________________

☐ 2. ____________________

☐ 3. ____________________

☐ 4. ____________________

☐ 5. ____________________

☐ 6. ____________________

☐ 7. ____________________

____

☐2-1. __________

☐2-2. __________

Table 2-1

Sample Number or Color	Number of Components	Texture		Arrangement	
		Interlocking	Noninterlocking	Random	Oriented

☐2-3. __________

☐2-4.

Table 2-2

Rock Number	Mineral	Type
05		
06		
08		
12		
13		
17		

☐2-5.

☐2-6.

☐2-7.

☐2-8.

☐ 2-9. ______

☐ 2-10. ______

☐ 2-11. ______

☐ 2-12. ______

☐ 2-13. ______

☐ 2-14. ______

☐ 2-15. ______

☐ 2-16. ______

☐ 2-17. ______

CHECKUP

1.

2.

☐ 2-18.

☐ 2-19.

☐ 2-20.

☐ 2-21.

☐ 2-22.

RESOURCE 5

No.	Name	Prediction	Results of tests
05			
06			
07			
08			
09			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			

RESOURCE 8

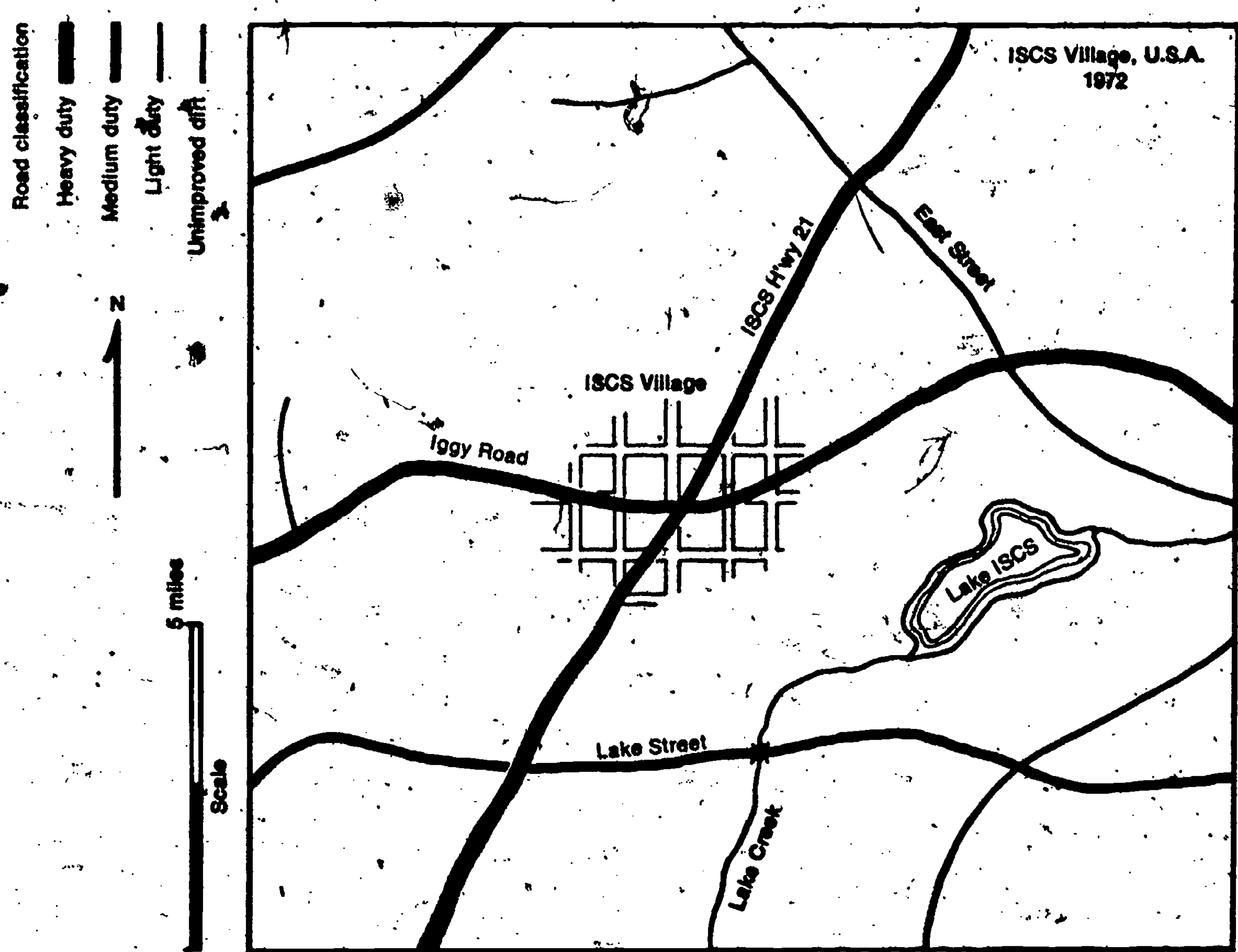
☐1. ____

☐2. ____

____

____

RESOURCE 10



☐ 1. ______________________________

____

____

☐ 2. ______________________________

____

☐ 3. ______________________________

____

☐ 4. ______________________________

RESOURCE 11

☐ 1. ______________________________

☐ 2. ______________________________

RESOURCE 13

☐ 1. ______________________________

☐ 2. ______________________________

Chapter 3 The Midlands, A Pathway to the Sea

☐ 3-1. ______________________________

☐ 3-2. ______________________________

☐ 3-3. ______________________________

☐ 3-4. ______________________________

☐ 3-5. ______________________________

☐ 3-6.

Table 3-1

Feature	Your prediction	Results of Test	
		Accept prediction.	Reject prediction. Revise if rejected.
Waterfalls (Figs. 3-13 and 3-14)			
Gullies (Fig. 3-15)			
Meanders (Figs. 3-16, 3-17, and 3-18)			

Prediction 1.

Labeled sketches:

Prediction 2.

Labeled sketch:

Prediction 3.

☐3-7. ____________________

____

RESOURCE 27

Table 1

	Slope (in cm)	Rate of Flow into Trough (in ml/sec)	Trough Bed	Speed (in cm/sec)
Trial 1	4	10	Normal	
Trial 2	8	10	Normal	
Trial 3	12	10	Normal	
Trial 4	4	20	Normal	
Trial 5	4	10	Gravel-covered	

RESOURCE 37

☐1. ____________________

____

☐2. ____________________

☐3. ____________________

☐4. ____________________

____

☐5. ____________________

Chapter 4
The Shorelands

☐4-1. ____________________

☐4-2. ____________________

____

____

☐4-3. ____________________

____

☐4-4. ____________________

____

____

☐4-5. ____________________

____

____

☐4-6. ____

____

☐4-7. ____

____

____

Sketch of Prediction:

Sketch of Prediction:

☐4-8. ____

☐4-9. ____

☐4-10. ____

☐4-11. ____

☐4-12. ____

RESOURCE 41

Sketch of Prediction:

How Well Am I Doing?

You probably wonder what you are expected to learn in this science course. You would like to know how well you are doing. This section of the book will help you find out. It contains a Self-Evaluation for each chapter. If you can answer all the questions, you're doing very well.

The Self-Evaluations are for your benefit. Your teacher will not use the results to give you a grade. Instead, you will grade yourself, since you are able to check your own answers as you go along.

Here's how to use the Self-Evaluations. When you finish a chapter, take the Self-Evaluation for that chapter. After answering the questions, turn to the Answer Key that is at the end of this section. The Answer Key will tell you whether your answers were right or wrong.

Some questions can be answered in more than one way. Your answers to these questions may not quite agree with those in the Answer Key. If you miss a question, review the material upon which it was based before going on to the next chapter. Page references are frequently included in the Answer Key to help you review.

On the next to last page of this booklet, there is a grid, which you can use to keep a record of your own progress.

List the numbers of all the resources you used for this chapter.

SELF-EVALUATION 1

☐ **1-1.** This unit is about the earth's landscape. In the chapters that follow, you will be asked many questions about the earth's features, such as how they may have been formed and what they may look like in the future. Where will you get the information to help you answer the questions that were referred to as resource problems?

☐ **1-2.** What observations have geologists used to support the idea that the continents might have been joined together in the past?

☐ **1-3.** Indicate with a check mark those areas that have a large number of earthquakes.

——— western coast of the U.S.

——— eastern coast of the U.S.

——— the state you live in

——— midway between North America and Europe

——— eastern coast of South America

☐**1-4.** Which theory or model explains the pattern of earthquakes on the earth, sea-floor spreading or the contraction theory? Explain your answer.

☐**1-5.** Look at the combined drawing in your textbook of the three landscapes. (Page 9, Figure 1-4 in your textbook.) Which section, A, B, or C (see the left margin), contains features that are most like the landscape where you live?

SELF-EVALUATION 2

List the numbers of all the resources you used for this chapter.

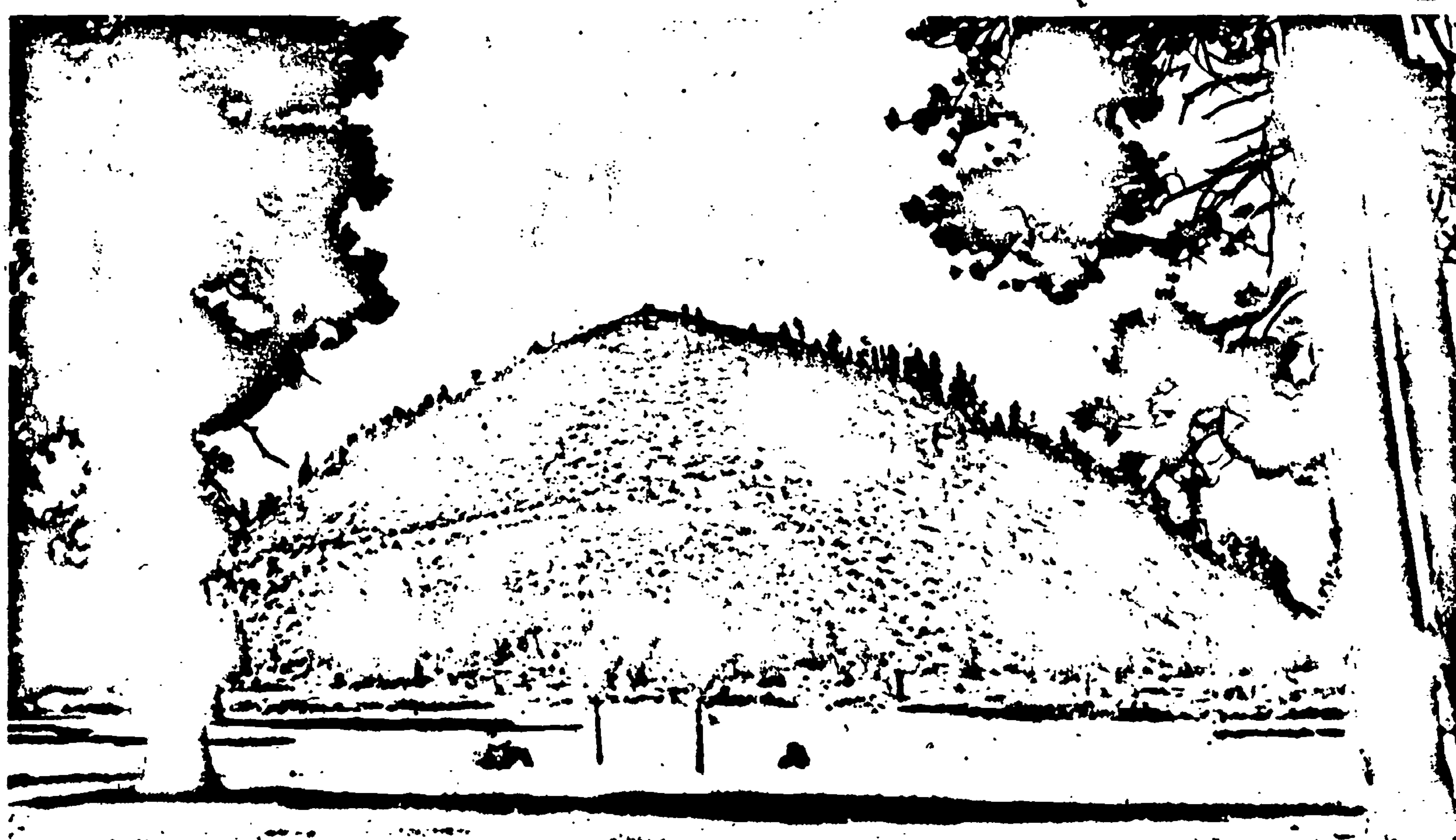
☐**2-1.** What interpretations can you make from the following observations: The tilt of sedimentary rocks reported on the side of a mountain is 21°. Several fossils of animals that once lived in ocean water have been located within the rocks.

☐**2-2.** Obtain from your teacher the rock samples 06 and 19. Describe very carefully the appearance of each rock.

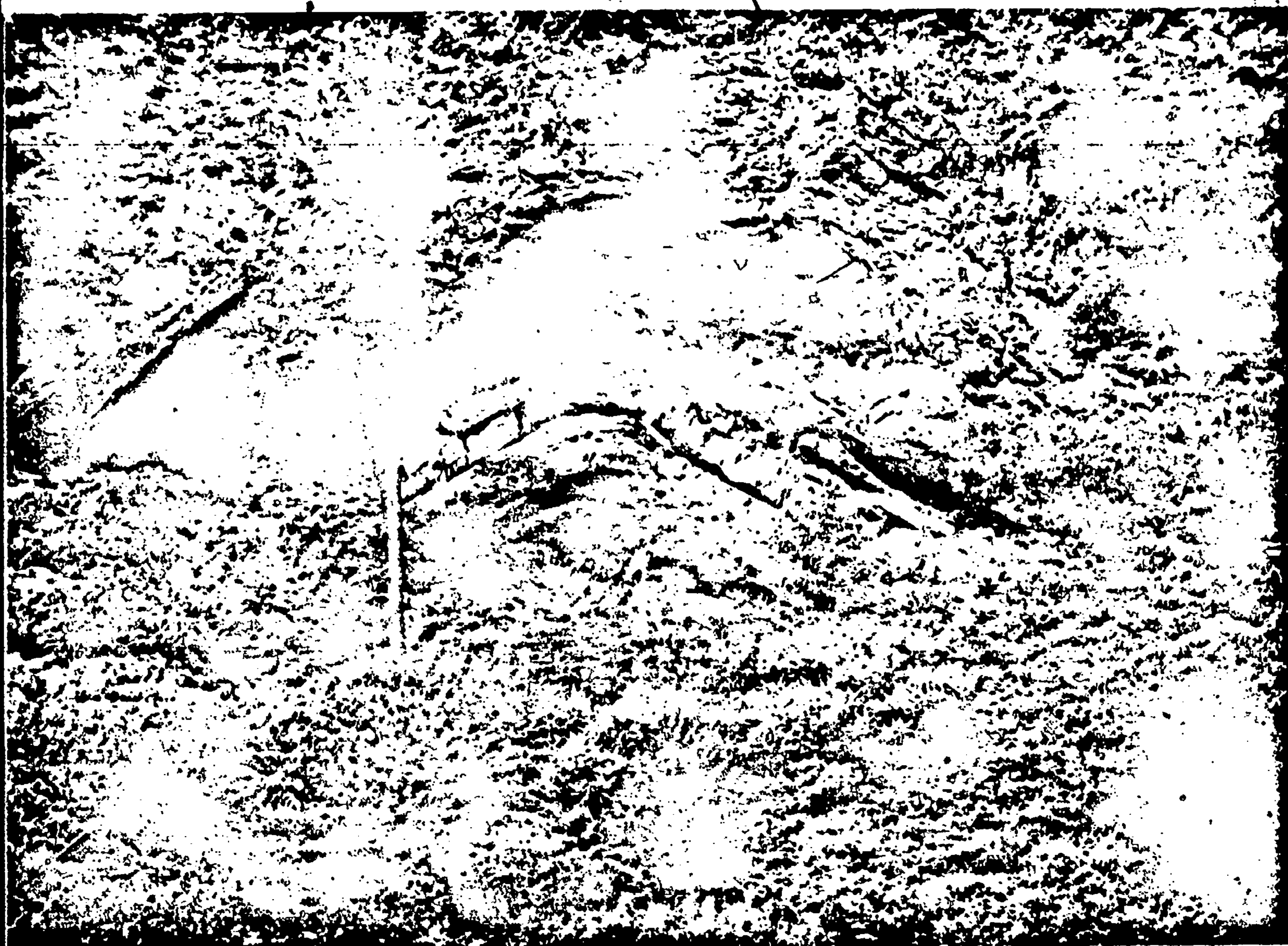
Do you think the rocks were formed in different ways? Explain your answer.

Identify at least one mineral in each rock.

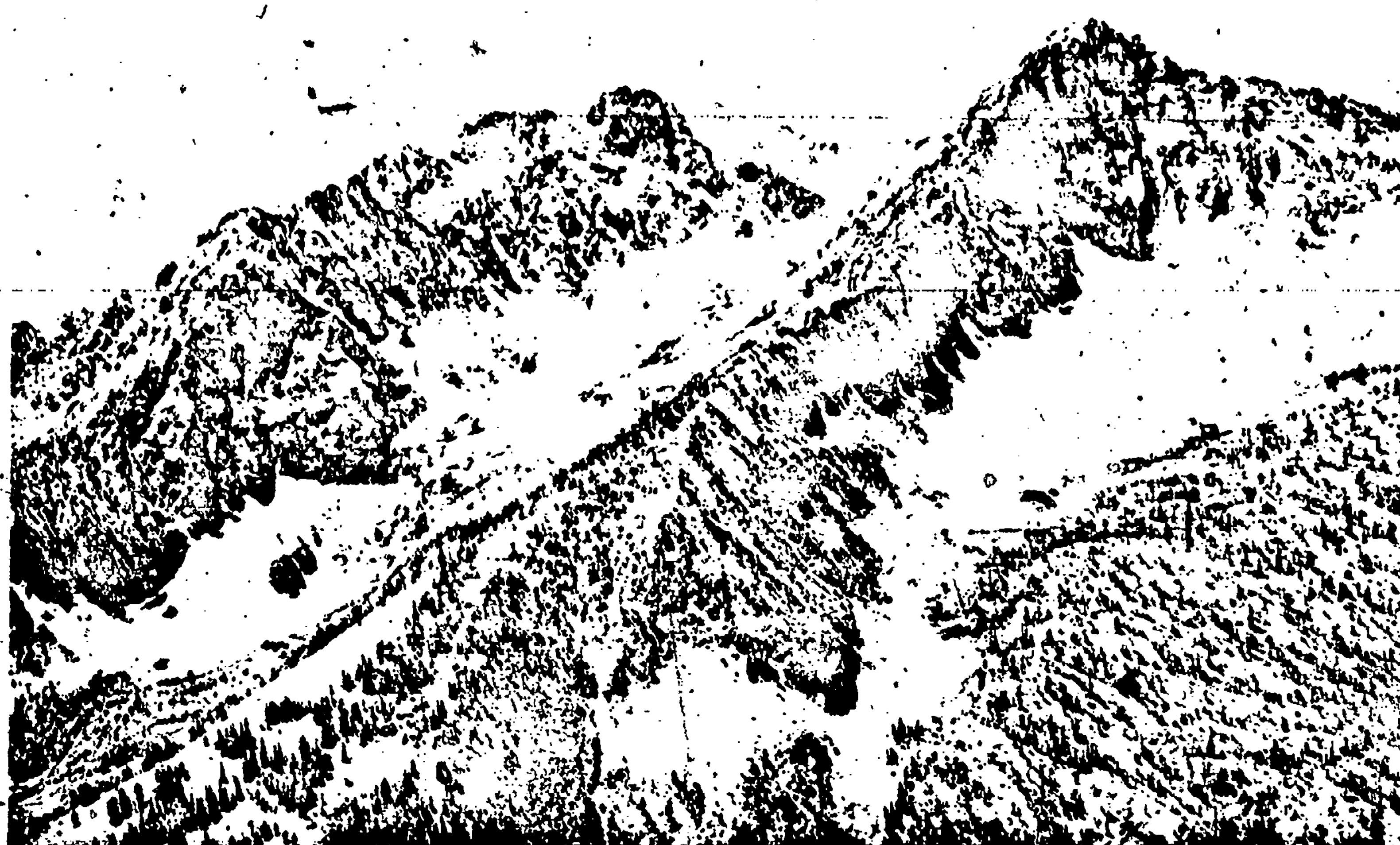
□2-3. Suppose you visited the mountain shown in the picture below to collect rocks. As you collected your rocks, suppose you found that most of them were one of three types—glassy, frothy, or fine-grained crystalline. Predict how the mountain was formed.



☐2-4. Describe the processes that probably formed the rock feature pictured below.



☐2-5. Describe how the mountains on the next page were probably formed.



☐2-6. Predict how the mountains shown in question 2-5 will look in the distant future.

☐2-7. Suppose the land around the Gulf of Mexico were uplifted in the future. Describe what you think the mountains would look like. What kind of rocks would you expect to find?

29

SELF-EVALUATION 3 List the numbers of all the resources you used for this chapter.

____

____

☐ **3-1.** What does the layered rock tell you about the history of the landscape shown in the picture below?

____

____

____

☐ **3-2.** In this chapter you did several experiments with the stream table to find out some properties of rivers. Some factors you studied were the slope of a river, the volume of water, and the smoothness of the bed. How do changes in these factors affect the ability of a river to erode the landscape?

____

____

____

A

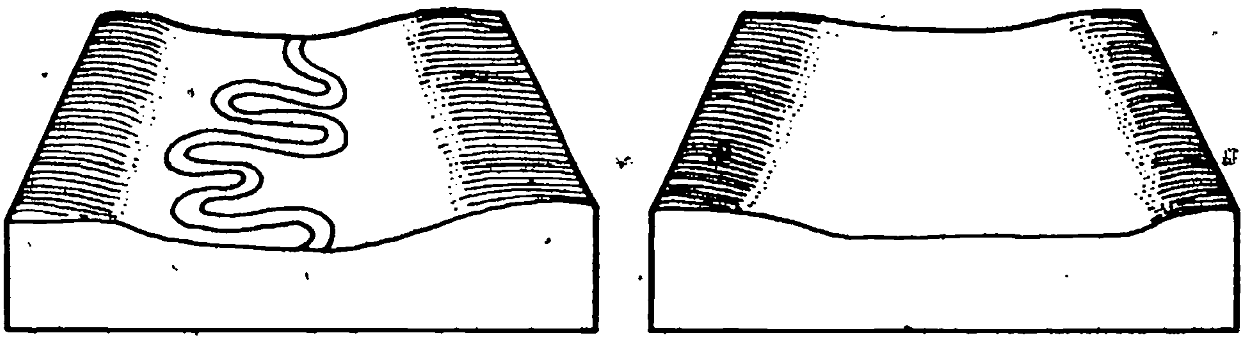
B

Questions 3-3 through 3-4 refer to Figures A and B above.

☐3-3. What are the major differences between the two streams in terms of potential energy? kinetic energy? erosive ability? rate of flow? size of particles carried in stream?

☐3-4. Predict what you think the landscape in each picture may look like in the future.

□3-5. The figure below shows a river flowing toward the bottom of the page with a series of meandering bends. Make a sketch showing what you think will be the path of the river some time in the future. Explain your sketch.

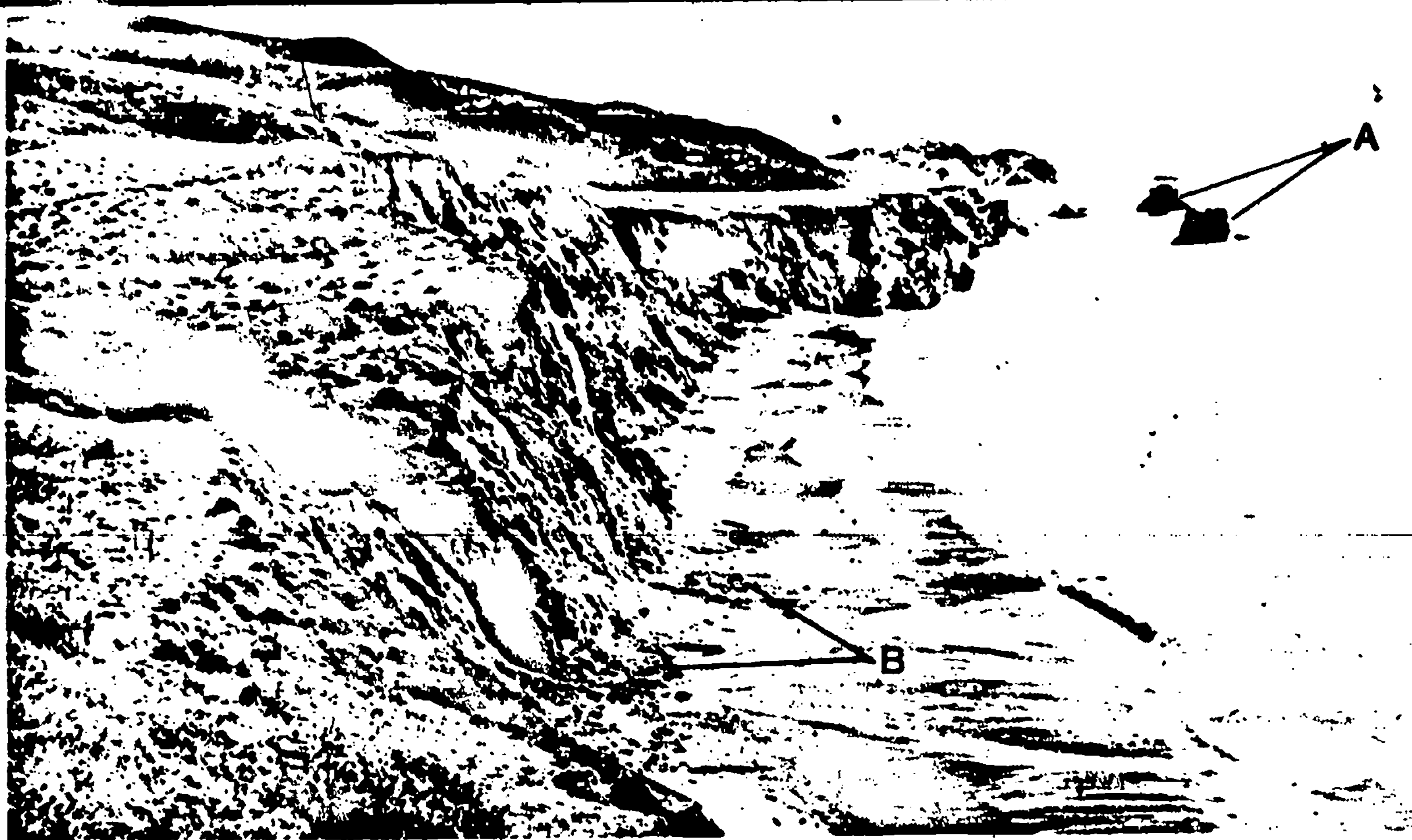


□3-6. Some of the most fertile farmland in the United States is now on the bottom of the Gulf of Mexico near the mouth of the Mississippi. Where did it come from? How did it get where it is?

SELF-EVALUATION 4

List the numbers of all the resources you used for this chapter.

□4.1. The following statements were made by an ISCS student about the landscape shown on the next page. Place a check mark (✓) next to each statement that you agree with. For those that you disagree with, state your reasons.



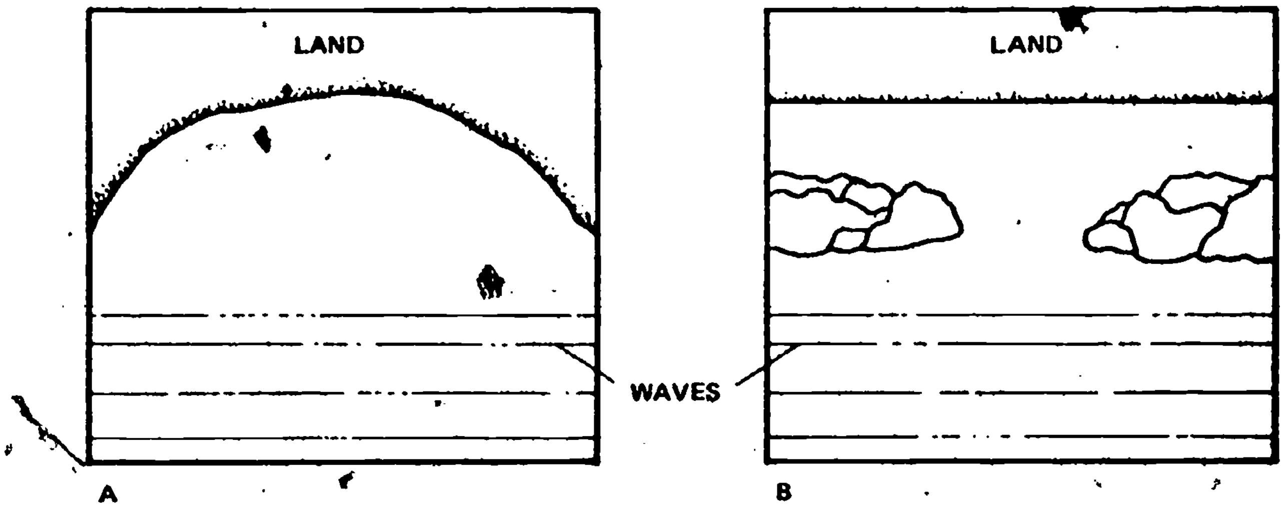
____a. There does not appear to be any evidence of uplift in this area.

____b. The rock outcrops at A are probably more resistant rock than the rock on the shore.

____c. The waves break because of interference or friction with the sea bottom.

____d. The debris that has accumulated at the bottom of the cliff B is evidence of storm activity.

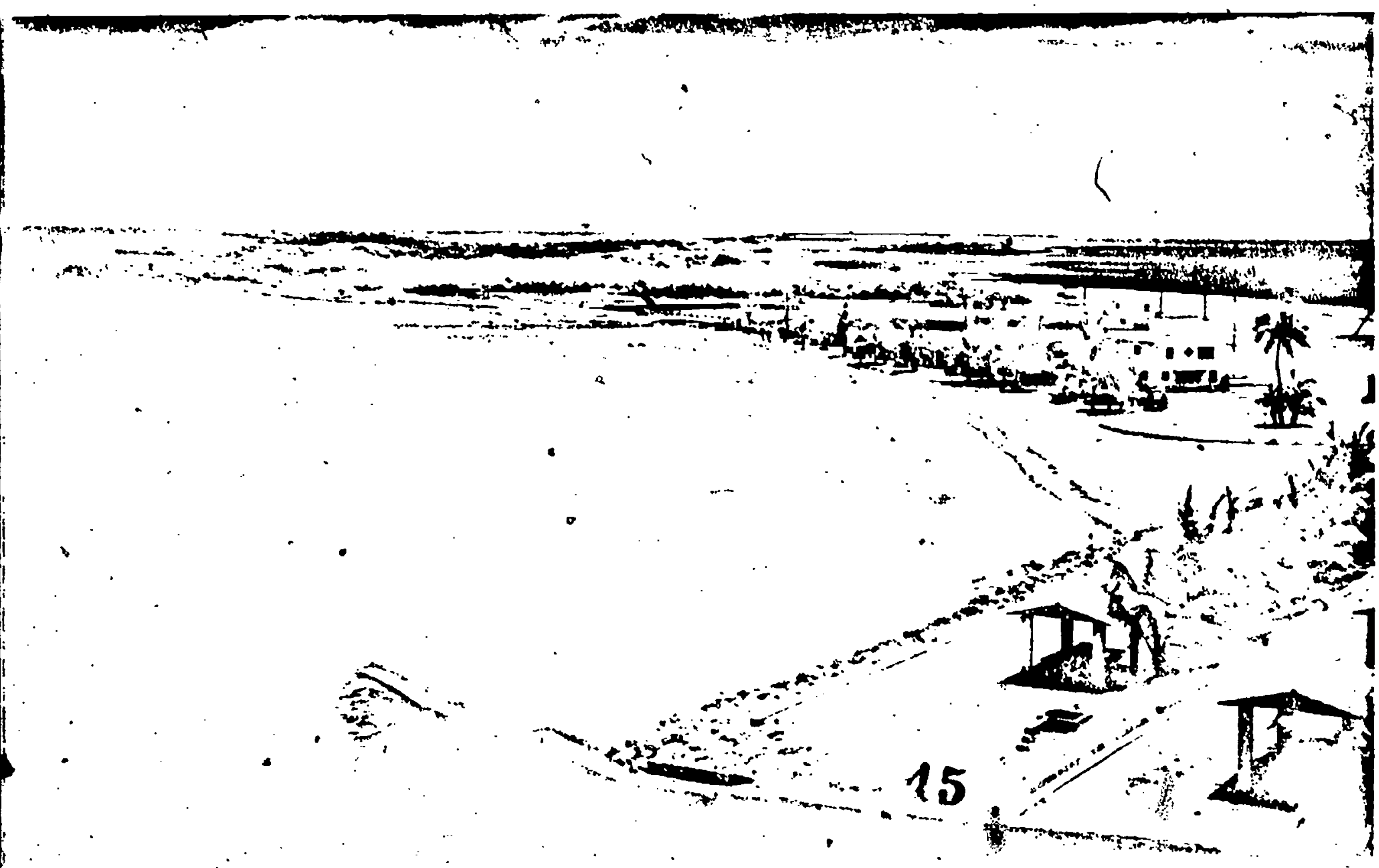
☐ **4-2.** For each diagram below, sketch a pattern that you believe describes the waves as they approach the shore.



☐ **4.3.** Use the picture below to answer the following questions. Do you think the beach house is in a good location? Why?

___

___



Was this picture taken at low, or high, tide? Explain your answer.

Do you think there are many sandbars in this area? Explain your answer.

☐**4-4.** Predict what would happen to the New Orleans harbor (below) if the area were not continuously dredged.

☐**4-5.** Place the letter D next to those features that are formed by deposition of earth material, and the letter E for those formed by the erosion of earth material.

____sandbar ____spit

____sea cave ____sea cliff ____beach

SELF EVALUATION ANSWER KEY

SELF-EVALUATION 1

1-1. Resources have been provided to help you answer the questions that are raised in each of the chapters of this unit. When you meet a resource question, you will be referred to a cluster of resources located at the end of the chapter. It is your responsibility to select and do the resource or resources that seem most appropriate. In some cases you will only have to do one or two resources to answer a resource problem, while in other cases you may have to use all the resources in a cluster. There are other places you might go for information—to your library, films, or even your community itself.

1-2. The observations that have been used to support continental drift are varied. They include the location of glacial features, such as grooves in rock and deposits of glacial till, on continents separated by oceans. This has led to the inference that these features could only exist if the continents were together during an ancient ice age. Another line of evidence you might have mentioned is the location of similar sequences of rocks on the Southern Hemisphere continents. See Resources 1 and 2 if you had trouble.

1-3. The following places would have large numbers of earthquakes: western coast of U.S. and midway between North America and Europe (mid-ocean ridge). If you live in a western state, you might have said the state you live in. The answers to this question are based on Activity 1-3, where you plotted the locations of a large number of earthquakes. Check your completed map of earthquakes, or look at the map on page 20 of *Crusty Problems*.

1-4. Sea-floor spreading seems to account for the pattern of earthquakes. According to the theory, new crust is forming at the mid-ocean ridges and spreading away from these areas. Crust is pulled back into the crust at deep-sea trenches. Thus, earthquakes should occur where the action is. In this case the action is along the mid-ocean ridges, the western edges of continents of North America and South America, across central Europe into Turkey and across to India. Thus, you should have noted that there are belts of earthquakes indicating the places where crustal plates are spreading apart or coming together. Review Resources 3 and 4 if you had trouble.

1-5. Your answer to this question depends on where you live. You may live in a mountain region, or you may live in the midlands. You may even live near the seashore. You can ask your teacher to check your answer. More than likely, you will recognize the kind of landscape of the nearby countryside even if you live in a city.

SELF-EVALUATION 2

2-1. You might have some of the following interpretations. Sedimentary rocks with a tilt of 21° have been uplifted from their original position. The fact that fossils of sea animals are found in a mountain might have led you to say that the land was uplifted from the sea (or sea level went down). Review pages 27-30 if you missed this.

2-2. Rock sample 06, which is a pink granite, is composed of more than one component or mineral. It contains a black mineral, a pink mineral, and an off-white mineral. The minerals (hornblende, feldspar, and quartz respectively) have an interlocking texture and are randomly arranged in the rock. Sample 19 is a sandstone. The rock is red in color, and if you examined it under a hand lens you probably noted that it appears to be composed of one mineral. It is noninterlocking. See pages 31-32 if you had trouble describing the rocks.

You should have concluded from your observations that the rocks were formed in different ways. Sample 06 was probably formed by the cooling of a hot molten material beneath the crust. The sandstone was probably formed from the accumulation of quartz grains in water, which were later cemented together. If you had trouble making interpretation, see Resources 6, 7, and 8. If you could not identify the mineral, check Resource 11.

2-3. The evidence suggests that the mountain is volcanic. If you look at the picture, you will see the mountain is cone-shaped, which is typical of volcanoes. The rocks described are igneous, which indicates that they are formed from molten material. See the section on Mono craters on pages 37-39, and check Resource 13.

2-4. The rock was apparently a flat-lying sedimentary rock that became folded because of pressures squeezing in from the sides. A model used to interpret folding is described in Resource 18.

2-5. The mountains pictured are wedge-shaped. One explanation for the formation of wedge-shaped mountains is slippage along a fault or an uplift. Whatever description you gave to help explain the shape of the mountains and their uplift is okay as long as it provides for the steep wedge shape of the mountains. If you would like some help on this, see pages 35-37 and Resource 17.

2-6. Today, the mountains in the picture are steep and jagged. In the distant future, they may look quite different. They may be very smooth. It is also possible that folding may occur. As time passes, vegetation may increase on the mountains. These are only a few of the many predictions you could have made. It is important for you to include in your prediction the idea that in the distant future these mountains may look very different than they do today.

2-7. If the land around the Gulf of Mexico were uplifted in the future, the mountains would very likely be composed of ripple-marked, tilted rock. The area would probably have a great deal of sedimentary rock with impressions of small sea creatures and many shells. It is not likely that this event will happen in your lifetime or even in the next few hundred years. However, you might like to think about it. Since a tremendous amount of soil and silt is being dumped into the Gulf of Mexico from the surrounding rivers that empty into it, it is quite possible that this could happen someday.

SELF-EVALUATION 3

3-1. The rock, because of its horizontal layers, is apparently sedimentary. It was probably formed when sediments were deposited underwater. These sediments could have hardened into rocks by chemical action. Thus, the cliff here was probably underwater a long time ago. See Resources 7, 8, and 9 in Chapter 2 for information about how this area may have been formed.

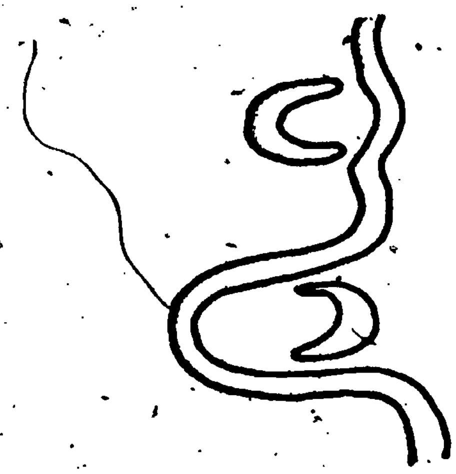
3-2. The greater the kinetic energy of a stream, the greater its erosive ability. Increasing the slope of a stream makes the water flow faster. Streams with high slopes should erode more material than those with gentle slopes. The more water in a stream, the greater its capacity to carry material away. You should have noted that the smoothness of the bed affects the velocity. Increased smoothness increases the velocity. If you need to review these ideas, see Resource Cluster B in Chapter 3.

3-3. The stream in picture A is a meandering stream flowing along relatively flat ground. The stream in picture B is obviously a mountain stream, falling down a sloped area. The two streams are quite different. One is moving relatively slowly, twisting and winding, while the other is moving very rapidly. They are alike in that they are both composed of moving water and both streams have energy. With reference to each variable you may have included the following: You may have said that the stream in picture B has more kinetic energy and the stream in picture A has more potential energy if you assumed that it was at a high elevation. There is another way you could look at energy in these situations. You could consider that because of its height, the mountain stream also has potential energy. As the water plunges down the mountain, its potential energy decreases. When you talk about kinetic and potential energy, everything depends on your point of view.

See pages 103 and 104 for more information about energy. For the meandering stream in A, the outer bank of the river is being eroded by faster water, which has more kinetic energy. For the mountain stream in B, most erosion is probably taking place as the water hits in the lowest part of the picture. See Resources 28 and 36 for erosive ability. The rate of flow is probably greater in river B than in A. The size of the particles being carried in A are probably smaller (mud and silt size) whereas, because of the higher velocity, large particles can be carried in B. See Resources 27 and 28.

3-4. In the future river A may change its course many times. As it changes its course, it may leave behind small lakes and islands. It is possible that the river may even disappear, leaving behind a dry channel. It may even increase in size, covering a much larger area. In the distant future, a huge waterfall may be formed in the landscape shown in picture B, or there may be a series of waterfalls, one after the other. There's also a possibility that a large gorge may be carved out of the rock. See Resource 36 for river A, and 33 for river B.

3-5. Your sketch should show the continued erosion of the outer bends of the stream. This would cause cutoffs or oxbows to occur. One possible path is shown here:

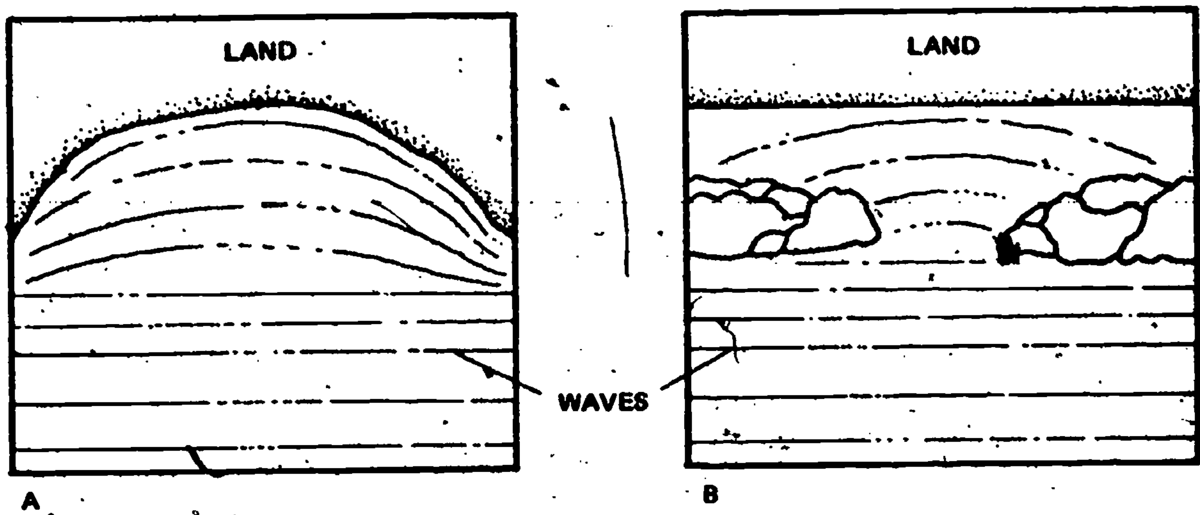


3-6. The Mississippi River drains a large portion of the midlands of the United States. If you look at the map in Resource 25, you will see that the Mississippi flows many, many miles through the midlands. Its origin is about Bemidji, Minnesota, from whence it flows south into the Gulf of Mexico. The area through which the Mississippi flows contains some of the most fertile farmland in the United States. As the river flows and tributaries join with the Mississippi, the water carries away the soil from these farmlands. Eventually, this soil is dumped in the Gulf of Mexico. If you ever visit the harbor at New Orleans, you will see huge pumps that work continuously to remove the sand from the bottom of the harbor in order to keep the channel open.

SELF-EVALUATION 4

4-1. You should have checked (agreed) items **b**, **c**, and **d**. If you did not agree with these, check Resource 38 for **b**, 39 for **c**, and Activities 4-1 through 4-3 for **d**. You may not have checked **a**, since there is evidence of a former beach or bench at a higher elevation. The flat surface in the upper center of the photograph well above the current beach might have been lifted to that elevation. Of course, you might have said that ocean level went down, and you could also be right.

4-2. The wave patterns might have looked like these:



Check Resource 40. For your information A is an example of waves bending because of refraction, and B because of diffraction.

4-3. If you studied the picture carefully, you probably came to the conclusion that this coastline does not receive violent wave action except perhaps during a storm. The beach house is sitting relatively unprotected. However, if you look closely at the trees, you will notice that they do not seem to be bent in any one direction, indicating that this area does not receive long periods of strong winds from a single direction. Probably the beach house is in a good location except, of course, in the event of a hurricane. You should have come to the conclusion that the picture was taken at low tide. (You can see a double row of seaweed and trash deposited along the beach as the tide went out.) Whether or not there are sandbars in this area is a more difficult question. You really have to study the picture very carefully. If you do, you will see a jetty in the foreground. This was built to prevent the transport of sand. If you visited this area, you would find that there are many sandbars, and sand could be transported up the coast. But the jetty has been built purposely to interrupt the wave action that transports this sand. Check Resource 46 for further information.

4-4. If you have studied the chapter on the midlands, you already know that tons of sand and silt are carried by the Mississippi River as it flows into the Gulf of Mexico. As the Mississippi River enters the Gulf, it slows down and drops some of its load. If the harbor were not continuously dredged, it would soon disappear, because the sand would pile up higher and higher.

4-5. You should have placed D for depositional features and E for erosional features as shown below. You can find further information on each feature by referring to the resources or pages listed next to each feature.

__D__ sandbar—Resource 46

__E__ sea cave—Page 161, and Resource 38

__D__ spit—Resource 46

__E__ sea cliff—Resource 38

__D__ beach—Pages 157–160

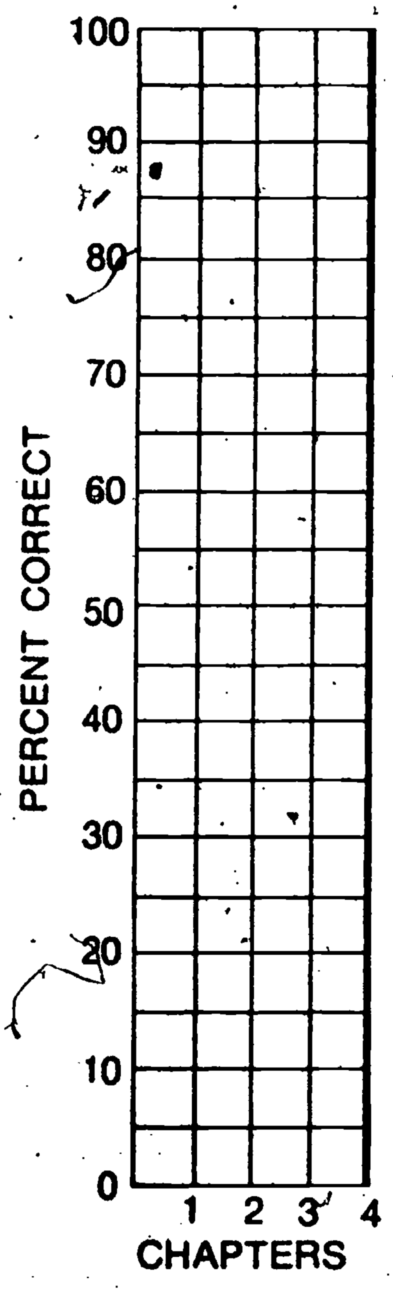
My Progress

Keep track of your progress in the course by plotting the percent correct for each Self Evaluation as you complete it.

$$\text{Percent correct} = \frac{\text{Number correct}}{\text{Number of questions}} \times 100$$

To find how you are doing, draw lines connecting these points. After you've tested yourself on all chapters, you may want to draw a best-fit line. But in the meantime, unless you always get the same percent correct, your graph will look like a series of mountain peaks.

RECORD OF MY PROGRESS



PICTURE CREDITS

27	Oregon State Highway Department
28-31	U.S. Forest Service
33	U.S. Department of the Interior, The National Park Service
34	Florida State News Bureau
35	U.S. Army Corps of Engineers